

## **Food Security, Ice, Climate and Community Health: Climate Change Impacts on Traditional Food Security in Canadian Inuit Communities**

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## Abstract

Traditional/country foods are critical resources for physical, as well as mental, social and economic health of individuals and communities across the Arctic. Despite this, shifts in traditional/ country food consumption have been taking place over the past 15 - 20 years related to a variety of changes in northern ecological, social, political and economic systems. Those related to ecological shifts have been in part previously associated with reduced confidence in food safety due to identified threats from environmental contaminants such as mercury and PCBs, and more recently the changes in species availability and accessibility due to shifting climatic conditions. Specifically, climate related changes and variability in the North have been associated with changes in animal, fish and plant population health and distribution, while changes in ice, snow, precipitation regimes, and other environmental factors have the potential to influence human travel and transportation in the North, and thus Inuit access to these wildlife resources. As such, climate change and variability has the potential to influence nutrition and health status among Inuit via impacts on aspects (availability, accessibility and quality) of traditional/country food security. Earlier phases of this project identified both positive and negative changes in the traditional/ country food harvest of Inuit communities in relation to changes and variability in climatic conditions. It was documented that environmental changes are already having impacts on both the availability of wildlife species and hunters' access to them in all regions studied. In some regions, Inuit have reported some influence of climate and environmental change on wildlife access and availability in comparison with the same hunting season in previous years. However, the impacts are not homogenous among all hunters and communities and both individuals and households show differential ability to adapt successfully. Factors such as access to economic resources and equipment, experience, and the nature of the adaptive strategy used appear to influence the success of hunter adaptations. Yet, our current commonly used assessment tools looking at household food insecurity

in Inuit regions do not represent this complexity well. As a result, we have decreasing confidence in the accuracy of results from these tools in capturing the full nature of the reality of Inuit food issues. This project has studied these issues through a variety of sub projects at the national, regional and community level including: a more holistic characterization of the Inuit food system through mixed quantitative-qualitative modeling approaches; methods to link and reconcile the contradictions between wildlife management and household food access; the review and development of new rapid assessment tools; the support of community-led food assessment processes and the development, implementation and evaluation of community-led interventions; the characterization of household food 'needs' and the impact of access to community food support mechanisms, such as community freezers, in addressing these needs.

## Key Messages

- Food security in Inuit regions is a complex phenomenon and forces such as environmental change and variability impact household food security status quite differently depending on such factors as household composition, geographic location, access to economic resources, numbers of hunters in the household, etc. Impacts on food security status are often just as variable within a community as they are between communities as a result.
- There is continued growth in the attention to this issue as evidenced in the peer reviewed literature. There is a continued focus on economic access to store foods and food quality issues related to traditional foods. Significant gaps in our understanding still exist in terms of other barriers to access than economic purchasing power.
- There is a conflict between the need of caribou and beluga for food security and wildlife conservation and an integrated plan is needed to between hunters and trappers and the public health professionals.

- There are serious ecological obstacles to substituting other traditional/country food species for caribou in some Inuit diets.
- Inuit lead exposure is associated with food security status.
- The existence of the Canadian Reindeer Herd in the Mackenzie Delta and a long-standing tradition of reindeer herding and meat consumption provides a promising culturally and nutritionally sustainable substitute for caribou in the Inuvialuit diet.
- Data originating from current methods of assessing food security in the Canadian North should be interpreted with caution as there is great variability in the adaptation and application of standard assessment tools; an Inuit-specific tool more able to capture the non-monetary (e.g. social) inputs into the household food system of both country and store foods is required.

## Objectives

### *General objectives*

- Gain a better understanding of Inuit food security, the role of environmental and socio-economic factors and their variability in household food security status;
- Assess the role of key adaptation/intervention strategies to address environmental change pressures on household food security in remote Inuit communities;
- Develop a quantitative ecosystem-based modeling framework integrating determinants of arctic food security, from the regional to the local scale, to support future decision-making;
- Help support the creation of a national mechanism for information exchange and learning among regions on this topic (Inuit Food Security working group through cooperation with ITK) and inform them with the state of knowledge on Inuit food security issues and strategies.

- Develop new tools and methods for assessing and investigating Inuit food security that better represent the nature of food challenges and the food system in Inuit communities.

### *Region-specific objectives*

#### *Nunavik*

- Develop standardized protocols to characterize and assess vulnerability and adaptation for traditional food security in Inuit communities;
- Identify and evaluate factors influencing household food security status (including climate and environmental change and a series of socio-demographic variables) and their distribution in Nunavik communities.

#### *Nunatsiavut*

- Determine the prevalence of factors influencing vulnerability and adaptive capacity for food security impacts of climate change;
- Assess the role of environmental (and other) factors in influencing individuals' use of a key food security adaptation mechanism (e.g. community freezer) in communities (Nain and Hopedale).
- Support communities in identifying, assessing and addressing local food security issues and in designing, implementing and evaluating community-based food interventions to address them.

#### *Inuvialuit Settlement Region*

- Determine traditional food species key to both nutritional and cultural security, and identify means to balance sustainable harvesting, nutrition and cultural use, if this becomes necessary;
- Determine the local and regional parameters of adaptation that are acceptable and viable among communities of the Inuvialuit Settlement Region;

- Develop detailed adaptation planning to allow the communities of the Inuvialuit Settlement Region to maintain food and cultural security;
- Incorporate the risk and benefits of traditional foods into planning for food security;
- Scale adaptation planning from the local to the re-gional level;
- Construct a comparative anthropological model to guide adaptation to climate change impacts on food security in 4 communities in the ISR;
- Determine the current state and future prospects for cultural food security in the Inuvialuit Settlement Region (ISR). In the long term it will facilitate community adaptation planning and assist the communities in developing region-wide adaptation planning for the maintenance of traditional food security across all the communities in the ISR.

### *Nunavut*

- Determine the level of wildlife harvest needed to sustain the current traditional diet and projected future needs.

## **Introduction**

Despite the recognized importance of traditional/country food as a critical resource for the health and well-being of northern populations (Donaldson et al., 2010; Van Oostdam et al., 2005), significant shifts in their consumption have been taking place over the past 15–20 years at the same time as dramatic changes in northern climatic, ecological, social, political and economic aspects. The changes related to ecological shifts have been in part associated with reduced confidence in food safety due to identified threats from environmental contaminants such as mercury and PCBs (e.g. Donaldson et al., 2010; VanOostdam et al., 2005), and more recently the changes in species availability and accessibility due to shifting climatic conditions (e.g. Furgal, 2008; Ford and Beaumier,

2010; Guyot et al., 2006; Berner et al., 2005; Chan et al., 2006). Specifically, climate related changes and variability in the North have been associated with changes in the diversity and distribution of the biotope (game, fish and and botanic) (Prowse et al., 2009; Wrona et al., 2005; Loeng et al. 2005; Callaghan et al. 2005). Changes in ice conditions, snow distribution, and rainfall frequencies and other climatic factors have the potential to influence human travel and transportation in the North, and thus Inuit access to their wildlife resources (Tremblay et al., 2006; Furgal and Seguin, 2006; Furgal 2008). As such, climate change and variability have the potential to impact nutrition and health status in the Inuit population through changes in traditional/country food availability, accessibility and quality.

Food security in Inuit regions of the North is already at alarming rates (Rosol et al., 2001; Egeland et al. 2011a, b) and therefore understanding the nature and distribution of pressures placed on this public health issue by environmental change is important. Previously under this project we have identified both positive and negative changes in the traditional/country food harvest in five Inuit communities in relation to changes and variability in climatic conditions. It has been documented that environmental changes are already having impacts on both the availability of wildlife species and hunters' access to them in all regions studied (Nunavik and Nunavut, e.g. Alain, 2008). Additionally, during the Nunavik Regional Inuit Health survey, respondents reported some influence of climate and environmental change on wildlife access and availability in comparison with the same hunting season in previous years (Furgal and Rochette, 2007).

However, as documented in earlier phases of this project, the impacts are not homogenous among individuals (e.g. hunters) in the same community or between households. Variability in adaptive capacity is evident representative of the reality of Inuit communities today. Factors such as access to economic resources and equipment, long-term experience, and the nature of the adaptive strategy employed seem to influence the success of hunter adaptations. Therefore,

it is important to study further these factors at different levels of organization in Inuit regions.

Further, through the analyses of harvest and local consumption data in Nunavut we determined that it is feasible to relate wildlife harvest data to traditional/country food use at both community and regional levels. Thus, it is possible to begin to model the relationship between climate projections, impacts on key environmental variables influencing availability of wildlife and/or Inuit access to traditional/country food species (e.g. ice conditions), and the level of viable consumption of those species in the community. This information is critical for furthering our understanding of the major determinants of traditional/country food consumption in Arctic communities and of the current and future impacts of climate variability and change and adaptation on traditional/country food consumption.

As the pace and variability of change increases, it is important to identify key aspects of individual and collective adaptive capacity that require enhancement to affect positive change and support effective responses with the aim of protecting and promoting traditional/country food consumption for Arctic Indigenous populations into the future. Our understanding of the determinants of adaptive capacity can be further enhanced by extending our work to larger groups of individuals in multiple communities, and exploring regional patterns of change and adaptation in the food sector.

The main goals of this project are to continue to enhance our understanding of the complexity of Inuit food security at the national, regional, community and household levels, support informed decision making in communities and regions, and support the development and evaluation of effective community interventions to address food challenges.

## Activities

### *National (all Inuit regions)*

- The Inuit Food Security Working Group is now in operation under the direction of ITK (Inuit Tapiriit Kanatami) and NICOH (National Inuit Committee on Health), and C Furgal and K Jameson (Food Security Network of NL) have presented to this group on the ArcticNet and PHAC funded activities under this project.
- The analytical framework developed by Furgal and Rajdev (resubmitted for publication) to organize analysis of food security issues and initiatives in Inuit regions has been applied to both Nunavik and Nunatsiavut communities to show the limited focus of many local support programs on some aspects of food security (e.g. social access). In Nunatsiavut this is being done in cooperation with local food security committees. The manuscript is proposed as an analytical framework for all regions in reviewing food security initiatives.
- A manuscript based on the policy and options review produced by C Furgal et al. for the Nunavut Government's Food Security Strategy has been drafted and communicates the approach for option analysis used in that region for possible replication in other regions. Presentations in Nunavik, for example, have generated interest in that region for this options analysis approach in their ongoing food security strategy discussions.
- A PDF (Dr. C. Juillet) was recruited in 2012 to work with C Furgal on the development of a quantitative integrated tool to model the complex relationship between climate and Arctic food security. C. Juillet, our team biostatistician/population ecologist has initiated this work with an initial focus at the regional scale in Nunatsiavut (2012) before extending to other regions (2013-2014). This tool is based on a more rigorous approach to the integrated modeling of arctic systems combining research on wildlife, climate and community health and



*valid screening tool for household food security in the Inuit context, in preparation*). This paper will be submitted before March 2014. In the second phase, socio-cultural dimensions were incorporated into the screening tool developed in the initial phase. The main objective was to develop a multidimensional composite tool adapted to the Inuit context. The socio-cultural dimensions were extracted from the IHS data. To this purpose, a multivariate approach was carried out.

- A workshop is planned for the third week of March in Ottawa to gather the chief medical officers and representatives from the regional Inuit organizations to discuss the state of knowledge in food safety and food security and to help plan for the next step of research.

### ***Nunavik***

- A food security working group was struck in relation to this project and ongoing initiatives in the region under the Nunavik Nutrition and Health Committee, Nunavik Regional Board of Health and Social Services in the spring of 2010. This committee continues to be the directing body for work in that region on this project. Ongoing analysis of the Qanuippitaa database is focusing the discussion on food security in the region at the Nunavik Nutrition and Health Committee table and the potential for the creation of a Regional Food Security strategy/policy. Among other things it has identified the need to explore an Inuit-specific (regional or national) food security metric that considers the non-monetary contribution of traditional/country foods to household food security status. This is currently being pursued by Furgal and Jameson and others in Nunatsiavut under a partnered project funded through the Public Health Agency of Canada. While that work will focus in Nunatsiavut, it is applicable to other Inuit regions including Nunavik.
- A PhD student (U King, Australia National Uni-versity) has been working under the

supervision of C Furgal with the Qanuippitaa database to explore the relationship between Inuit participation in hunting and other land-based activities and health, including food security status. One manuscript was submitted this year, analysis was completed and the remaining thesis chapters/manuscripts are in draft form for submission and completion this calendar year.

- For practical reasons (data access and collaboration opportunities) C Juillet and C Furgal have identified Nunavik as a key region to pursue the development and application of the quantitative integrated tool to model the complex relationship between climate and Arctic food security. Over the last year, they have started to work with the Qanuippitaa? How Are We? database from the Inuit Health Survey conducted in 2004 adopting a multivariate approach to analysis of the factors influencing food security in Nunavik. This work, approved by the Nunavik Regional Board of Health and Social Services and Institut National de Santé Publique du Québec, included preliminary statistical exploration of the relationships between variables in the database (individual survey) that are, or can be, interpreted as being determinants of food security (perceived preference of country foods, socio-economic status, time participating in land activities etc.). This work was presented at the ArcticNet ASM in Halifax. The goal of this exploratory work was to see if there are a few key variables that explain a large amount of the variability in peoples' responses to questions that we could focus on in future statistical modeling.

### ***Nunatsiavut***

- The food security activities of this project in the region, in connection with the Public Health Agency of Canada funded project led by the Food Security Network of NL (collaborator, Kristie Jameson) were adopted as a component of the Sustainable Communities Initiative in the region to be able to link team members and food security initiatives. This project helped support the formation of community food assessment

committees in Rigolet, Hopedale (previously created) and Nain, Nunatsiavut and hire one community coordinator in each community and a regional coordinator.

- A training workshop was held for team members in Nain in May, 2013 bringing together community coordinators, project advisors, the regional coordinator and research team members.
- Community-led food assessments are now underway in Nain and Rigolet (completed in Hopedale) and food interventions have already been developed and implemented in the community of Hopedale (community gardening initiative, composting workshop training, community freezer development).
- Household food security surveys are being conducted in Nain and Hopedale in February/ March of 2014. Included in these surveys are questions on household use of specific food support programs in communities (including community freezers) as well as a characterization of household “needs” related to food access.
- The database from the anomalous ice year of 2009-10 was further analysed to look at issues of food access during that winter and a manuscript is in preparation with honours undergraduate student Radoslaw Odolczyk.
- Two manuscripts from the thesis of J Organ have been submitted on the review and evaluation of the earlier version of the Nain freezer.
- The community-based ice monitoring activities in Nunatsiavut were refocused in new proposals for funding submitted to AANDC and Health Canada to look more specifically at development of technologies for surveillance of safe ice conditions. These proposals were successful and the ice monitoring activities are now being directed by the Nunatsiavut Government – Environment Division and are not a component of the food security project presented here.

### ***Inuvialuit Settlement Region***

- The purpose of the work in this region was to develop a framework and model to relate issues of Inuit health, access to country food, and diet, within a forum that is mutually relevant to wildlife managers. This work represents, therefore, an effort to bring together wildlife conservation, into the broader discourse of Inuit diet, nutrition and food security, and, likewise, situate issues of Inuit diet, nutrition and health, within the broader context of harvest and wildlife management.
- We have characterized regional country food consumption and established baseline determinations of country food harvest for selected species of wildlife (caribou, ringed seal, and beluga), in the five Inuit Health Survey (2007-2008) regions of Canada. These results were presented at the 2013 ArcticNet Annual Scientific Meeting, and are summarized in a manuscript (Kenny T, Egeland G, Chan HM. *Estimation of Harvest Need of Wildlife for Consumption among Inuit In The Canadian Arctic*), which is in preparation and anticipated for submission in February of 2014.
- A scoping review of literature was conducted to examine the extent, range and nature of research activity, and community initiatives, regarding Inuit food security, wildlife management and harvester support within the Canadian Arctic. Through this work, we have identified commonalities between these distinct, yet related, fields of interest and are working to develop an integrative framework to identify how wildlife management and health promotion may best co-evolve to meet the needs of Inuit communities within the context of environmental change. The results of this review are summarized in two manuscripts that are in preparation (Kenny T-A, Fillion M, Chan HM. 2014. *Reconciling Indigenous Food Security & Wildlife Management in the Canadian Arctic*; Kenny T-A, Fillion M, Chan HM. 2014. *Food Security*

*Research and Food Security Programs among Inuit Regions in Canada*) and are anticipated for submission no later than March of 2014.

- We plan to host a workshop in Inuvik in the last week of March in partnership with the Inuvialuit Regional Corporation to validate our research results with the local hunters and trappers and public health professionals.

### ***Nunavut***

- Using the data collected from the Inuit Health Survey, we have established estimates of regional harvest requirements for ringed seal, beluga and caribou in 2007-2008 to match consumption levels in communities. Using frequency responses from a total of 806 Inuit men and 1275 Inuit women, we characterized annual traditional/country food consumption in Nuanvut, ISR and Nunasiavut. Daily consumption equivalents for children and adolescents were estimated by applying conversion factors to adult consumption results.

## **Results**

### ***National (all Inuit Regions)***

The conceptual framework which we have built for the quantitative integrated tool to model the complex relationships between climate and Arctic food security has provided valuable information on the depth and breadth of the data required to holistically model Arctic food security in a changing environment. If we take an ecological perspective to start the modeling of arctic food security people are the top consumers in a typical ecological food chain that begins with producers (e.g. plants) followed by several levels of consumers (e.g. geese, caribou, arctic fox, polar bear). Each level of this food chain is susceptible to the influence of contaminants in the environment and infectious disease, both of which may exacerbate effects of one another. Humans, as the top consumers, may be even more susceptible due to

the effects of bioaccumulation through the food chain. Understanding the biology of species at all levels of the food chain, and how populations are affected by climate and weather, is essential to be able to model the access to and availability of traditional/country foods by Arctic residents. The modeling of access to and availability of traditional/country foods in the face of climate change requires all environmental components, biotic and abiotic, such as geological and landscape characteristics, which may influence climatic impacts.

When we connect the ecological aspects of the food security system with the anthropogenic aspects of the system, we incorporate complexity at a higher spatial and temporal level as we must consider the availability and use of market foods as well. The availability of market foods, provides alternatives to reach a state of food security, however, a disproportionate intake of market versus traditional/country foods also has some negative impacts on health. Societal components of the food security system, politics, economy and culture, also need to be assessed as each will inevitably influence decision making processes regarding food security and community health (Figure 1). The manuscript presenting this framework is being completed and will be submitted in March 2014 (Juillet and Furgal).

The new multidimensional composite tool for Inuit household food security assessment is being completed. Sensitivity, specificity and convergent validity tests will be carried out in 2014-15. We hope to submit a paper regarding the development of that tool before July 2014 (Philibert A, Fillion M and Chan HM. *An ecosystemic approach of the food security scale in the Inuit context*, in preparation).

### ***Nunavik***

The Nunavik Nutrition and Health Committee are currently discussing the rate of food insecurity in the region and the accuracy of the rate obtained in 1992 and 2004 using their 'one question' assessment tool included in the Inuit Health Survey in that region. It is

slightly less than 3 times lower than the rate reported for Nunavut (24% compared to 68%). It is believed that the Nunavik assessment question is perhaps a more accurate assessment of hunger (basic lacking of food of any kind) while the tool used in the other regions and in Canada at large is exclusively a measure of various levels of food security only associated with economic purchasing power of the household. It is argued in our work that this does not accurately portray the Inuit food system which is comprised of both country and store foods, and accessed via a variety of means (sharing, gifting, hunting, purchasing etc). A more holistic understanding of the issue is required.

Analyses of the Nunavik Inuit Health Survey data (Qanuippitaa?) indicate that a high level of participation to hunting, fishing and gathering activities (comparable data not available for the other Inuit regions) is not positively correlated with many positive health outcomes. Similarly, there is a more complex relationship between hunting, fishing, collecting, sharing of food, and then preparation and consumption of traditional/country foods than previously thought. The PhD thesis by U King, looking at the risks and benefits of hunting in Inuit communities through an analysis of the Nunavik dataset, has completed all data analysis and submitted one manuscript this year (King and Furgal, Is hunting healthy? IJERPH, in review). Three other manuscripts are being drafted for submission in the coming year and the thesis is to be completed before December 31st 2014. The analysis deconstructs the issues of hunting, food access, sharing, consumption and health to better understand the complexity of food security issues and health in Nunavik in support of the development of more helpful interventions for the region to address food-related concerns.

A preliminary study based upon the individual questionnaire of the Qanuippitaa? How Are We? database was used to assess the potential to use the survey data to develop our integrated model of food security to support decision-making (i.e investigating all components simultaneously in one holistic model

instead of looking at each question individually). We did this by compiling answers to questions selected using our new conceptual framework and looking for similar patterns in answers between questions related to food security using exploratory multivariate analyses. The database contains some very interesting data in attributes of the food security system, or key determinants of food security, beyond just socio-demographic variables and the responses to the household food security question. Many of the responses to these questions are highly correlated such that we could focus on a smaller number of variables to look at determinants of food security in the region and still be able to explain a good amount of the variance in individuals' responses to questions. The main result indicated that three independent patterns associated primarily with income and perception of food cost (country or store bought); this accounts for most of the variation in our sub-dataset and should be included in the focus of future analyses. If no new results about the status of food security were provided, it confirmed that using a more multivariate and integrated statistical approach is it likely possible to gain a better and more holistic understanding of food security in the region. The latest results of this work were presented at the 2013 ArcticNet meeting in Halifax.

### *Nunatsiavut*

Two manuscripts were prepared and submitted (in review) from the evaluation of the previous model of the Nain community freezer (Organ 2014; Organ et al. 2014). That work showed that a community food support program was alleviating food stresses for some individuals associated with environmental change. However, such a program also creates some tensions in the community in regards to pressures on resources, challenges to previously existing social structures for sharing, the creation of a potential replacement for or threat to the importance of the development of land skills and acquisition of knowledge among young hunters and others. It is argued that these factors need to be considered in the evolution of community food support programs as adaptations to climate change induced stress on food security.

Two new thesis students are now working in Nunatsiavut on these issues. E Wilson (Trent U) is looking at the issue of household food “need” and the relationship with access to community freezers and other support programs, and K McTavish (Trent U) is studying the community-led food assessment process as an adaptation planning process for Inuit food systems in response to environmental and other forms of stress.

The work in Nunatsiavut has grown through cooperation with the Food Security Network of Newfoundland and Labrador (FSN NL) to now include the Community-led Food Assessment initiative in the region, linking community food assessment committees, coordinators with the research team and regional advisors. Regional training and community support have been provided this year, food security assessments will take place in February/March 2014 in Hopedale and Nain, data analysis is taking place for a food security survey conducted in Rigolet (conducted in cooperation with an externally funded project over the past three years) and semi-directed interviews were completed on the topic of food “needs” in Hopedale by MA student E Willson in Nov 2013. Hopedale has begun community gardening initiatives and a community freezer this past year and Rigolet has also performed a household perception survey regarding food intervention plans. These are all aspects of the community-led process to identify food challenges, develop local interventions and implement and evaluate pilot strategies at the local scale. Data has been gathered on many of these aspects and is being analysed currently. This regional food security team will be providing information and data to support decision making and discussions related to the possibility of a regional food security strategy in the future.

### ***Inuvialuit Settlement Region***

We have characterized regional country food consumption and established baseline determinations of country food harvest for selected species of wildlife (caribou, ringed seal, and beluga), in the

five Inuit Health Survey (2007-2008) regions of Canada. These results were presented at the 2013 ArcticNet Annual Scientific Meeting, and are summarized in a manuscript (Kenny T, Egeland G, Chan HM. *Estimation of Harvest Need of Wildlife for Consumption among Inuit In The Canadian Arctic*), which is in preparation and anticipated for submission in February of 2014.

We have conducted a scoping review of literature to examine the extent, range and nature of research activity, and community initiatives, regarding Inuit food security, wildlife management and harvester support within the Canadian Arctic. Through this work, we have identified commonalities between these distinct, yet related, fields of interest and are working to develop an integrative framework to identify how wildlife management and health promotion may best co-evolve to meet the needs of Inuit communities within the context of environmental change. The results of this review are summarized in two manuscripts that are in preparation (Kenny T-A, Fillion M, Chan HM. 2014. *Reconciling Indigenous Food Security & Wildlife Management in the Canadian Arctic*; Kenny T-A, Fillion M, Chan HM. 2014. *Food Security Research and Food Security Programs among Inuit Regions in Canada*) and are anticipated for submission no later than March of 2014.

### ***Nunavut***

Our research in this region reaffirms the importance of traditional/country food to the contemporary Inuit diet. Consumption of traditional/country food was widely reported in all five regions, with caribou being the traditional/country food that was consumed in highest amounts, and in highest prevalence, with no region reporting less than 90% consumption rates. Results from this study suggest that an average beluga feeds between 46 – 124 women, and 26 – 66 men, depending on the region in which it is consumed. An average ringed seal may feed between 2 – 9 women and 1 – 4 men, again, depending on the region. Regarding the consumption of caribou, we found that on the lower end of the spectrum, a caribou may feed as little as

2 – 4 people annually, however, on the higher end, an individual would require approximately 2 caribou to satisfy current dietary intake levels.

## Discussion

Food security issues in the circumpolar North include those associated with food availability (abundance and diversity of food), accessibility (social, physical, economic and political accessibility), quality (chemical/ nutrient, biological, and social/cultural) and use (food skills and knowledge). Much more is known about food quality (chemical) and accessibility than other elements which may be critical in light of ongoing environmental changes influencing physical access and diversity and abundance of traditional/ country food species in Arctic regions.

Much of the work to date on the topic of food security and climate change in Inuit and other regions has depicted the pattern of impacts as being homogenous among groups of individuals (e.g. hunters, communities etc). Our results are showing that this is not the case in the present context and, in fact, the pattern of vulnerabilities and impacts associated with environmental change forces on food security are much more complex than previously thought.

As a result, it is important to continue to utilize the existing comprehensive databases from the Inuit Health Surveys which contain both food security status information as well as the suite of factors influencing or characterising where food insecurity occurs within a community and which types of individuals, households and communities are likely at greatest risk in the future. The Inuit Health Survey conducted in Nunavik in 2004, Nunavut in 2007 and Inuvialuit and Nunatsiavut in 2008 provide excellent data on food intake, contaminant exposure, observations of environmental change, food security status and their relationships with the health status of the participants. A variety of different assessment tools have been used to determine food insecurity rates in Canada and the Canadian North. It is only in Nunavik that it

is currently possible to compare food security rates over time where the same tool has been used more than twice in the same region; results in this region are considerably lower than the other regions, yet qualitative reports from the region depict similar problems or challenges existing related to food access and availability. Recent results from Nunavut (re: the highest rates of food insecurity in the developing world are reported in Nunavut, Canada where 68% of homes are reported to be food insecure) argue for the development of a new Inuit-specific tool to assess this issue in various regions. One of the major shortcomings in the Inuit food security research to date is this lack of a specific, and yet simple instrument to accurately measure food security in Inuit communities. Our results in the development of new tool based on the Inuit health survey have shown promise to accurately predict food insecurity and is powerful enough to show the relationship between food security and key variables such as essential nutrient intake. We will validate this new tool next year and use it to test the effectiveness of various new intervention programs to improve food security in specific regions. Work in Nunatsiavut is taking a different approach to this issue and developing a Nunatsiavut-specific adaptation of a survey tool and definition in support of that region's interests in this area.

Our project is informing Inuit regional and community actions around food security. We are moving the project from knowledge to action in this most recent year and the plans for next year and beyond. In Nunavut our work has informed policy option analysis and development for the food security strategy. At the regional and community consultation workshops in the Inuvialuit Settlement Region and through our work on Nunavut harvest statistics and Inuit food consumption data, we learned that there is clear conflict between the need of wildlife as country food and the conservation effort to limit the number of animals that can be harvested. Our research results in relating numbers of caribou, beluga whales and ringed seal needed for harvest in a region to the current dietary need of the people will help the regional governments to make informed choices on wildlife management that will

have minimal impact on the food security of the local communities.

In Nunavik and Nunatsiavut the project is informing an enhanced and more holistic understanding of the issue of food security, and supporting community and regional capacity building through community, led intervention development and evaluation (Nunatsiavut).

This study brings together two multidisciplinary research teams and their networks working in different Inuit regions of the Canadian North. We continue to use different but complementary approaches to studying the relationships between environmental and other forms of change and food security status in Inuit homes. The project activities are now bridging research, or knowledge generation, action. In cooperation with our partners we are supporting community capacity building on the topic and the empowerment of communities and regions in assessing strengths and weaknesses in their food systems and designing, implementing and evaluating appropriately scaled policy and program approaches to address these issues.

## Conclusion

Our results collected in the last few years on levels of harvest and consumption of traditional/country food provides a basis for assessing different dimensions of food-related vulnerability and adaptability in the different Inuit regions across the Canadian North. They also provides information on levels of traditional/country food dependence, alternate traditional/country food options, and existing adaptations (e.g. species substitution, community freezers, etc). In addition to environmental factors such as climate change, Inuit families face many challenges to food security, including low income levels, changing diets, high food costs, and lack of awareness of healthy eating habits. Community members face barriers to traditional/country food consumption, such as high costs of hunting, changes in lifestyle and changes in cultural

practices among Inuit. The shift in caribou numbers throughout the North is having significant impacts on household food security status and has the potential to impact nutritional and cultural well-being (e.g. recent ban on caribou hunting for the George River herd by the Government of NL). These issues surrounding key resource (staple item) viability in the future, along with other factors such as food preference and food choice, must be considered in the adaptation planning process. The complexity of interrelationships among the multiple and multifaceted features affecting food security emerge when we address the issue from a holistic food systems perspective. Valuable lessons are being learned throughout the Inuit regions and some communities are implementing adaptation mechanisms already. This project is helping communities and regions learn from these experiences, and make the best use of existing data to support informed decision making and take policy and programming action on these issues now and in the future.

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